

Food Plants, Distribution, and Variation in Abundance of *Conotelus mexicanus* Murray, a Recently Discovered Immigrant Insect in Hawaii (Coleoptera: Nitidulidae)¹

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With minor exceptions, immigrant insects are the most important pests in Hawaii. This situation, although not unique to Hawaii, behooves us to investigate new immigrant insects to determine their status as pests. This paper presents some observations on a newly discovered nitidulid beetle, *Conotelus mexicanus* Murray, made during the course of investigations undertaken to determine whether or not this beetle was destructive or beneficial to the production of some of our local crops. Observations were made chiefly on Oahu during September to December of 1955 and during 1956 and to a lesser extent on Hawaii, Maui, and Kauai during October and November of 1956.

The presence in Hawaii of *C. mexicanus*, commonly known as the fruit bud beetle (Essig, 1929), was first reported by Bianchi in 1955 (Bianchi, 1955). According to Bianchi's report, this beetle was first observed by Mr. E. J. Ford at Waianae, Oahu, in March, 1955, and subsequently by hikers at Nanakuli in August of the same year. The beetle apparently entered Hawaii from either the southwestern part of the United States or from the areas south of it, for it is known that this beetle occurs in Arizona, southeastern California, Sonora (Morrill, 1916), Baja California, Mexico, British Honduras, Guatamala, Panama, and Perlas Island (Blackwelder, 1944).

The adults of *C. mexicanus*, which infest the flowers of various plants, may be distinguished readily from other flower infesting insects. They are slender insects, approximately 3 mm. long and 1 mm. wide. They are jet black and superficially resemble thrips; however, they are much larger than any of the flower-inhabiting thrips found in Hawaii. When infested flowers are examined, numerous adults may be seen moving about in a characteristic thrips-like fashion.

There is very little published information on the biology of *C. mexicanus*. The adults are known to feed on pollen, although at times they have been observed to feed on the base of the pistil (Morrill, 1916). They apparently

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feed also on nectar, for in Hawaii the adults frequently have been observed deep in the campanulate flowers of the morning glory where nectar is present. Although present in large numbers, there was no evidence of feeding either on the pistil, ovary, or the surrounding tissues of the corolla.

The economic importance of *C. mexicanus* is also inadequately known. Morrill (1916, 1917) reported that *C. mexicanus* is destructive to the flowers of roses, blackberries, peaches, and citrus. In citrus blossoms this beetle was observed to gnaw at the base of the pistil, thus damaging the flower. In other flowers, such as cotton and cucumber, the beetle appeared to cause no visible damage. It was also suggested that the beetle might be beneficial because of possible value in pollination.

The present study was begun shortly after the discovery of this beetle in Hawaii when a few adults of *C. mexicanus* were found on passion fruit flowers, *Passiflora edulis* f. *flavicarpa* Degener, in the eastern foothills of the Waianae range, a short distance from the area from which this insect was first reported by Bianchi. The main objectives were to determine whether or not *C. mexicanus* was a pollinator of the passion fruit flower and also to determine the status of this insect as a pest of some of our other crops. This study showed that *C. mexicanus* is of little or no importance as a pollinator of passion fruit flowers, and also that it is not a pest of any of our important crops. Yet it appeared desirable to present some of the results of the observations with the thought that they will contribute, in some measure, to our knowledge on this nitidulid beetle whose biology is so little known.

FOOD PLANTS OF *C. mexicanus*

The flowers of a large number of crop, ornamental, and wild plants were examined in order to determine the range of plant species infested by *C. mexicanus*. For each species of flower an infestation rating was made according to the following scale: few, when 0 to 4 beetles were present per flower; moderate, when 5 to 10 beetles were present; and abundant, when 10 or more were present. This procedure is, without doubt, subject to considerable error; however, a rough qualitative picture on the abundance of adults in various species of flowers may be obtained.

The results presented in table 1 indicate the range of plant species infested as well as the relative abundance of the adults of *C. mexicanus* in different flowers. The adults have been found in the flowers of 13 species, of which 3 are crop plants, 6 ornamental plants, and 4 wild plants. It is also evident from table 1 that the adults were most abundant in the flowers of species in the family Convolvulaceae. Although infested flowers in general were campanulate to funnel-shaped, not all flowers with this form were found to be infested.

Some of the flowers mentioned by Morrill (1916, 1917) as infested in Arizona were not found to be infested in Hawaii. According to Morrill the

flowers infested by *C. mexicanus* were blackberries, cucumbers, peaches, roses, cotton, oranges, and lemons. Although nearly all of these are grown in Hawaii on a limited scale, the observations made to date indicate that with the exception of cotton, the flowers of none of these plants were infested.

TABLE 1. The flowers of various plants in which *Conotelus mexicanus* was found during 1955.

FAMILY	SPECIES	COMMON NAME	TYPE OF PLANT	RELATIVE ABUNDANCE ¹
Convolvulaceae . . .	<i>Ipomoea alba</i> L.	moon flower	wild	moderate
	<i>I. batatas</i> (L.) Poir	sweet potato	crop	few
	<i>I. cairica</i> (L.) Sweet	koali'ai'	wild	abundant
	<i>I. congesta</i> R. Brown	koali'awahia	"	abundant
	<i>I. crassicaulis</i> (Bentham) Robin	bush morning glory	ornamental	abundant
	<i>I. tuberosa</i> L.	wood rose	"	few
Malvaceae	<i>Merremia aegyptia</i> (L.) Urban	hairy merremia	wild	few
	<i>Hibiscus rosa-sinensis</i> L.	hibiscus	ornamental	few
Rubiaceae	<i>Gossypium</i> sp.	cotton (cultivated)	crop	few
	<i>Gardenia jasminoides</i> Ellis	gardenia	ornamental	few
Leguminosae	<i>Canavalia microcarpa</i> (D. C.) Piper	maunaloa	"	few
Apocynaceae	<i>Stemmadenia galeotiana</i> (A. Rich.) Miers	lechose	"	few
Passifloraceae	<i>Passiflora edulis</i> f. <i>flavicarpa</i> Degener	passion fruit	crop	few

¹ Ratings on abundance are: few, 0 to 4 beetles per flower; moderate, 5 to 9 per flower; and abundant, 10 or more per flower.

DISTRIBUTION OF *C. mexicanus* IN HAWAII

According to Bianchi (Bianchi, 1955) the known areas in which *C. mexicanus* occurred were Nanakuli and Waianae, Oahu. In the present study, surveys were conducted to determine how widely *C. mexicanus* was distributed on Oahu and on some of the other islands. Two morning glory plants, *Ipomoea cairica* (L.) Sweet and *I. congesta* R. Brown, were used as indicator plants because the observations on the species of flowers infested (table 1) showed that *C. mexicanus* was most consistently associated with the flowers of these plants, and also because these species were widely distributed throughout the Hawaiian Islands. In this survey, morning glory flowers from various localities on Oahu, Kauai, Hawaii, and Maui were examined. Surveys were not made on Molokai and Lanai.

The results of this survey showed that *C. mexicanus* is considerably more widespread than originally reported. As shown in figure 1, this insect was present in all localities on Oahu where flower samples were taken. It was also

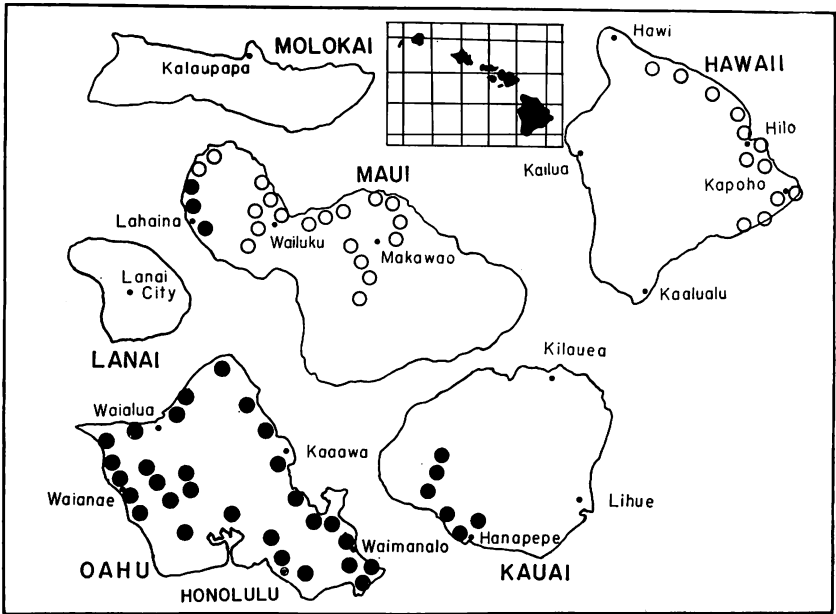


FIG. 1. The presently known distribution of *C. mexicanus* in Hawaii. Circles indicate localities where morning glory flowers were sampled; shaded circles indicate localities where *C. mexicanus* was present; open circles localities where it was not present. On Oahu *C. mexicanus* was present in all 40 localities sampled; however, all localities are not indicated.

present on Kauai where samples of morning glory flowers were examined on September 29 and 30, 1956. On that island *C. mexicanus* was found between Elele and Kekaha and in the Puukapele areas. Surveys conducted on the island of Hawaii in the Puna, Hilo, and Hamakua areas during November 14 to 21, 1956, failed to show the presence of *C. mexicanus* in the areas covered by the survey; however, those conducted on Maui during November 22 to 23, 1956, showed that *C. mexicanus* was established in the Lahaina area but not in the Wailuku, Kahalui, Kula, Makawao, Haiku, and Paia areas.

The absence of *C. mexicanus* in certain areas of the Territory of Hawaii does not necessarily indicate that conditions in those areas are unfavorable for establishment. It means that the establishment of *C. mexicanus* in the Hawaiian Islands is a recent one and that the insect has not yet reached its ultimate distribution. It is, therefore, a matter of time before all available habitats will be occupied and *C. mexicanus* will be distributed more widely than is shown by this study.

VARIATION IN ABUNDANCE OF *C. mexicanus*

During the month of May, 1955, efforts were made to determine the abundance of the adults in different localities on Oahu. An index of abun-

dance was obtained by counting the number of adult beetles in the flowers of *Ipomoea cairica* and *I. congesta*. In each locality a sample of 25 fully opened flowers was picked at random and the number of adults in each flower counted.

The data obtained from 11 localities, presented in table 2, show significant variation in the indices of abundance of *C. mexicanus* among different localities. The lowest index of 0.04 beetles per flower was obtained from samples taken in Kaaawa. Low indices were also obtained from samples taken from Hauula, Blow Hole, and Makapuu areas. The highest index was obtained from Lualualei. Other areas from which relatively high values were obtained were Mikilua, Waianae, and Halawa. Although it is not possible to draw definite conclusions, it appears from the data and field observations that *C. mexicanus* is better adapted to the dry leeward areas than to the more humid windward areas. This observation is not at all surprising in view of the occurrence of *C. mexicanus* in the arid southwestern part of the United States.

TABLE 2. The indices of abundance of the adults of *C. mexicanus* in morning glory flowers in different localities on Oahu. Data obtained during May, 1956.

SAMPLE NO.	LOCALITY	TOTAL NO. OF BEETLES PER 25 FLOWERS	MEAN NO. OF BEETLES PER FLOWER	MEAN LOG NO. OF BEETLES PER FLOWER ¹
1.....	Blow Hole	8	0.32	0.79
2.....	Makapuu	23	0.92	0.23
3.....	Waimanalo A	70	2.80	0.52
4.....	" B	47	1.88	0.40
5.....	" C	47	1.88	0.40
6.....	Mikilua A	70	2.80	0.41
7.....	" B	174	6.96	0.82
8.....	" C	44	1.76	0.35
9.....	Lualualei A	65	2.60	0.47
10.....	" B	398	15.92	1.10
11.....	Waianae A	52	2.18	0.40
12.....	" B	195	7.80	0.86
13.....	Halawa	229	9.16	0.93
14.....	Kaaawa	1	0.04	0.01
15.....	Hauula A	17	0.68	0.17
16.....	" B	13	0.52	0.12
17.....	" C	9	0.36	0.09
18.....	Paumalu	78	3.12	0.51
19.....	Pupukea	118	4.72	0.64
Least significant difference at 5 per cent level.....				0.15
Least significant difference at 1 per cent level.....				0.20

¹ In subjecting the data to an analysis of variance each variate was transformed according to the form $y = \log_{10}(x + 1)$, where y is the value of the transformed variate and x the original variate (Morris, 1955). The writer is indebted to Dr. Maurice Blackburn, Department of Zoology and Entomology, University of Hawaii, for directing his attention to this transformation.

The data presented also show significant variation in abundance of *C. mexicanus* among samples taken within the same areas. The indices obtained from Waimanalo and Hauula showed no significant variation; however, those obtained from Mikilua, Lualualei, and Waianae showed highly significant variations in certain samples. Aside from inherent differences in attractiveness of flowers of morning glory plants, such variations no doubt are manifestations of local differences in environmental conditions. One of the factors which was observed to influence abundance in localized areas was exposure to wind. Flowers from morning glory vines growing in sites exposed to the wind were observed to harbor fewer beetles than those in sheltered sites. Another factor which appeared to influence abundance in localized areas was the presence of ants. At Lualualei it was observed that in cotton flowers visited by large numbers of the crazy ant, *Paratrechina longicornis* (Latreille), *C. mexicanus* was present in smaller numbers than in those in which ants were not present.

SUMMARY

Field observations on *Conotelus mexicanus* Murray, a pollen-feeding nitidulid beetle recently found for the first time in Hawaii, were made during the latter part of 1955 and throughout 1956. At present this insect is of no importance in the pollination of the passion fruit, *Passiflora edulis* f. *flavicarpa*, and of no economic importance as a pest. The adults were found in the flowers of 13 species of which 3 are crop plants, 6 ornamental plants, and 4 wild plants. The adults were found most abundantly in the morning glory plants *Ipomea cairica* and *I. congesta*. Surveys conducted on Oahu, Kauai, Hawaii, and Maui showed that *C. mexicanus* is present on Oahu, Kauai, and Maui but was not found in the Puna, Hilo, and Hamakua Coast areas on Hawaii. On Oahu significant variations in the indices of abundance were found among different localities as well as within localities. The causes of these variations were not investigated, but the beetle was found to be most numerous in the dry leeward parts of Oahu and appears to be better adapted to such areas.

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